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ABSTRACT

Innovative and alternative methods of wastewater treatment can improve the efficiency and lower the cost of waste treatment procedures. Described in this instructor's guide is a one-hour learning session for citizens interested in improving water quality planning and decision making. Among the topics covered are the need for alternative wastewater treatment methods, various available technologies, selection procedures, and economic considerations. A supplementary slide-tape program is available as part of the Working for Clean Water Project. (Author/WB)

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Working for Clean Water
An Information Program for Advisory Groups

Innovative and Alternative Technologies

Instructor Guide

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION

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Innovative and Alternative Technologies

There is a great need for innovative and alternative methods of wastewater treatment. The estimated wastewater costs for 1990 are $7 billion. Many people have questioned the ability of our economy to support such large costs. Savings have been estimated of $1 billion if innovative processes are used to treat the wastewaters instead of conventional secondary and advanced waste treatment techniques. Upon completion of this session the participant should be able to:

- understand the need for less expensive alternatives to meet our water quality goals
- recognize the various forms of alternative technologies
- know the qualifying criteria for innovative technology
- understand the methodology by which innovative technologies may be selected
- know the economic advantages of both increased federal grants and reduced user charges to the community due to alternative and innovative technologies.

Required Materials

☐ Set of slides plus tape for the audiovisual presentation, "Innovative and Alternative Technology for Municipal Wastewater Treatment"

☐ Slide projector, cassette tape player, and screen

☐ Set of flip charts plus easel and/or transparencies and overhead projector for guided discussion

☐ Copy of the handbook, "Innovative and Alternative Technologies" for each participant

Continued on next page

☐Copy of material in Appendix B for each participant. Each participant should have a copy of the Innovative and Alternative Technology Decision-Making Methodology, Innovative and Alternative Technology Assessment Procedures, and Quaker Lake Wastewater Treatment Hypothetical Options.

Important Notes

1. Before the presentation of this material the instructor should review at least one of the case studies from those at the end of the citizen handbook or develop one using a local situation. Develop various treatment options that appear feasible for that site.

2. The instructor should become familiar with the following units on wastewater treatment processes:

- Municipal Wastewater Processes: Overview
- Municipal Wastewater Processes: Details
- Small Systems.

They provide useful background information about the range of treatment options.

Suggested Activities

Introductory Comments	5 minutes
A/V Presentation	15 minutes
Guided Discussion	15-25 minutes
Decision-Making Exercise	15-25 minutes
Closing Remarks	5 minutes
TOTAL TIME	50-70 minutes

Introductory Comments (5 minutes)

1. Ask the participants if they know how much wastewater treatment is expected to cost in 1990. It will cost 7 billion dollars! Tell them that 1 billion dollars could be saved if innovative methods of treatment were used.

NOTE: Copies of the charts referred to in the Guided Discussion are in the Appendix.

2. Innovative and Alternative Technologies are frequently less expensive than the conventional alternatives. In addition, operations costs are usually less expensive. Both lead to lower costs for the local government.

A/V Presentation (15 minutes)

1. Ask the participants to look for the following key points in the slide/tape program:

   a. What economic incentive is there to use innovative technology?

   b. What are several categories of alternative technology?

   c. What criteria must be met for innovative technology for both conventional and alternative methods of treatment?

   d. List specific examples of innovative treatment. Watch for possible options that may be useful in the local situation.

2. Show the slide/tape program, "Innovative and Alternative Technology for Municipal Wastewater Treatment." This slide tape discusses the Clean Water Act sections that encourage innovation. It covers the increased funding incentives used to obtain more innovation and then reviews alternative technology, innovative criteria, and examples.

A/V script is in the Appendix.

Guided Discussion (15-25 minutes)

Use chart 1.

Encourage discussion. This is not to be a lecture!

1. Systems using innovative and alternative technology qualify for increased federal funding of the eligible costs. Eligible costs include those for analysis, design, and construction of cost-effective alternatives for collection and treatment. They do not include excessive collection system costs or house connections.

Interesting point.

Mention that the 10% increase in federal funding is really a 40% reduction in the amount of money the local community must pay.

Use chart 2 for list of alternative technologies categories. Use charts 3-6 for specific examples.

2. Alternative technologies emphasize recycle and reuse. Give specific examples of alternative technologies.

Use chart 7 with charts 8 and 9 as overlays.

3. What criteria apply to innovative technology?

- Improved operational reliability
- Better management of toxic materials
- Increased environmental benefits
- Improved joint treatment potential
- 15% life-cycle cost reduction
- 20% net primary energy reduction

Ask the participants what each criterion means to them. Note how resources and money might be saved by each criterion.

4. Discuss in general the trade-offs between increasing risk and increasing potential for state-of-the-art advancement (benefit) in designing municipal treatment facilities. Mention that EPA has shown a willingness to accept a degree of risk in order to achieve advances in innovative alternatives and cost reduction.

Use chart 10.

5. To be considered innovative, conventional technologies must meet either the energy or cost reduction criterion. Discuss what is meant by conventional technology and give examples.

6. This discussion focuses upon the choice of alternative and innovative systems designed mainly for treating wastewaters. Such investments can achieve more than the mere treatment of wastes, however. Resources can be recovered; examples include nutrients and energy. Facilities can be used for many purposes such as meeting rooms, recreation, and open spaces. Discuss them.

Use chart 11

Decision-Making Exercise (15-20 minutes)

1. Hand out copies of "Quaker Lake Wastewater Treatment — Hypothetical Options."

A copy is included in the Appendix.

2. Go through the decision-making methodology to decide whether or not the various options are innovative and get 85% funding.

Use the Assessment Procedures and Decision-Making Methodologies (figures 1 and 2) in the citizen handbook.

Use option F, the most unique, as an example to familarize the participants with the assessment procedure used to determine if an alternative technology or conventional treatment method will get funded as innovative. Using a series of transparent overlays, go through the procedure step-wise. At each decision point overlay another transparency to show the use of the decision-making chart. (A flip chart with the decision path highlighted could also be used.) The purpose is to familarize the participant with the decisions that the agency must make, as well as the alternatives available.

Use chart 12 and overlay transparencies of charts 13 to 16.

3. Ask the participants to try one of the options.

4. The answers!

Using Figure 1 in the handbook,

		Decision Points			
		A	B	C	
Option	Alternative Technology?	Fully Proven?	Meets Innovative Criteria?	Cost Effective?	Innovative Technology (85% Funding)
A	Yes	No	Yes	Yes	Yes
B	---------- Not equivalent effluent ----------				
C	No	Use Figure 2, Conventional Technology			
D	No	Use Figure 2, Conventional Technology			
E	Yes	Yes	---	Yes	Yes
F	Yes	No	Yes	No	Yes

Closing Remarks (5 minutes)

1. Review the main points concerning innovative and alternative technologies.

   a. What is a conventional method of treating or transporting wastewater?

      Treatment:
      Biological - trickling filters, activated sludge
      Chemical - lime or alum addition
      Physical - sand filtration, carbon adsorption
      Transportation: gravity sewers

   b. Why shouldn't we use the same thing used the last time for treating wastewater?

      Maybe what they used the last time is fine, on the other hand maybe something else is better. The situation should be analyzed and the various alternatives checked out. Facility uses other than wastewater treatment should also be explored.

   c. Can money and energy be saved with innovative technology?

      Yes, two criteria defining innovation include cost and energy saving. An additional 10% share of facilities funding is available from the federal government if those processes qualify as innovative.

   d. What are innovative technologies?

      Those alternative technologies that satisfy any one of the six criteria are considered innovative. Conventional methods must satisfy the energy or cost saving criterion to qualify as innovative.

   e. Can alternative technologies improve our management of toxic materials?

      The alternative technologies in general are better able to cope with toxic materials. This is especially noteworthy since many industrial materials are carcinogenic.

2. Summarize any dicussion pertaining to the local situation.

Selected Resources

Innovative and Alternative Technology Assessment Manual. MCD-53, Publication Number EPA-430/9-78-009. Washington, DC: U.S. Environmental Protection Agency, 1978. 318 pp.

This is an excellent reference manual for innovative and alternative technology assessment and cost-effectiveness analysis. The general classification and screening approach is covered as well as a detailed description of the criteria on which innovative and alternative technologies were developed. There are 117 separate fact sheets which describe municipal wastewater processes including cost and energy data. Fact sheets of onsite disposal alternatives are also included. It is available from the General Services Administration, Centralized Mailing Services, Building 41, Denver Federal Center, Denver, CO 80225. Indicate the MCD number and the title of the publication when ordering.

U.S. Environmental Protection Agency. "Grants for Construction of Treatment Works, Innovative and Alternative Technology Guidelines, Title 40, Chapter 1, Part 35." Federal Register, vol. 43, no. 188, subpart E, appendix E, 27 September 1978, pp. 44098-44099.

These guidelines provide the criteria for identifying and evaluating innovative and alternative wastewater treatment processes and techniques. Your local reference librarian will be able to tell you how to obtain copies of the Federal Register.

Appendix

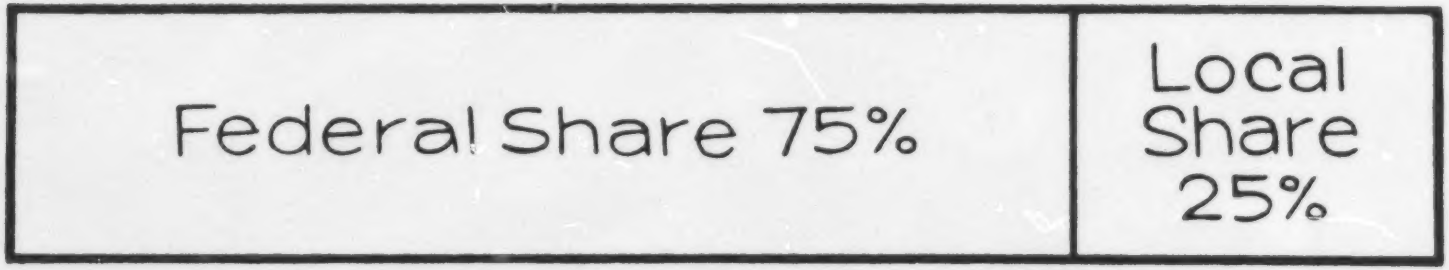
A. Copies of charts for use by the instructor in the Guided Discussion. Pages may be used to make transparencies or the contents may be copied onto flip charts.

1. Bar Graph
2. Alternative Technologies
3. Effluent Treatment
4. Sludge Treatment
5. Energy Recovery
6. Individual and Onsite Systems
7. Innovative Technology Criteria
8. Overlay for Chart 7
9. Overlay for Chart 7
10. Conventional Technologies
11. Multiple Uses
12. Decision-Making Chart
13. Overlay to use with Chart 12
14. Overlay to use with Charts 12 and 13
15. Overlay to use with Charts 12 to 14
16. Overlay to use with Charts 12 to 15

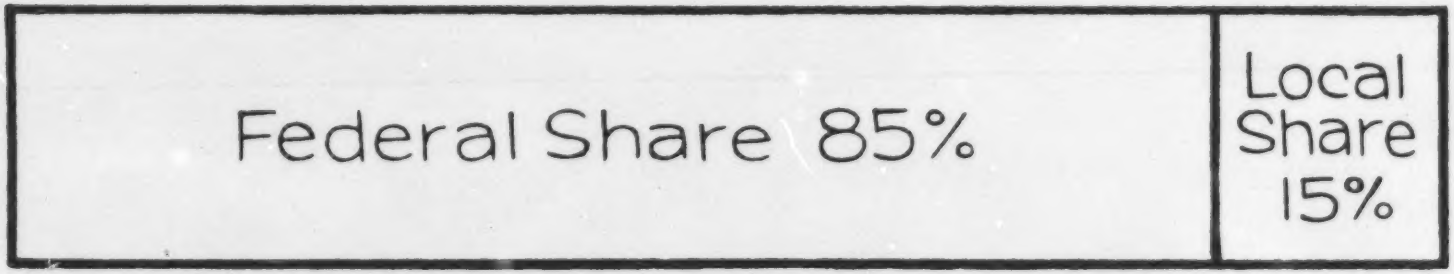
B. Handouts for use by the instructor in the Guided Discussion.

1. Quaker Lake Wastewater Treatment — Hypothetical Options

C. Copy of the script for the slide/tape program, "Innovative and Alternative Technology for Municipal Wastewater Treatment."



Conventional Technology



Innovative and Alternative Technologies

ALTERNATIVE TECHNOLOGIES

- Effluent treatment
- Sludge treatment
- Energy recovery
- Individual and onsite systems

EFFLUENT TREATMENT

- Land treatment
- Aquifer recharge
- Aquaculture/silviculture/horticulture
- Direct reuse (non-potable water)
- Revegetation of disturbed land
- Containment ponds
- Treatment and storage prior to land application
- Preapplication treatment

SLUDGE TREATMENT

- Land application
- Composting prior to land application
- Drying prior to land application

ENERGY RECOVERY

- Co-disposal of sludge and refuse
- Anaerobic digestion with methane recovery
- Self-sustaining incineration

INDIVIDUAL AND ONSITE SYSTEMS

- Onsite treatment
- Cluster treatment
- Septage treatment
- Alternative collection systems for small communities

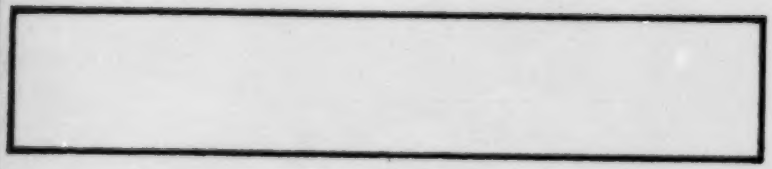
INNOVATIVE TECHNOLOGY CRITERIA

- Improved operational reliability
- Better management of toxic materials
- Increased environmental benefits
- Improved joint treatment potential
- 15% life-cycle cost reduction
- 20% net primary energy reduction

for

not - fully-proven

Alternative Technologies



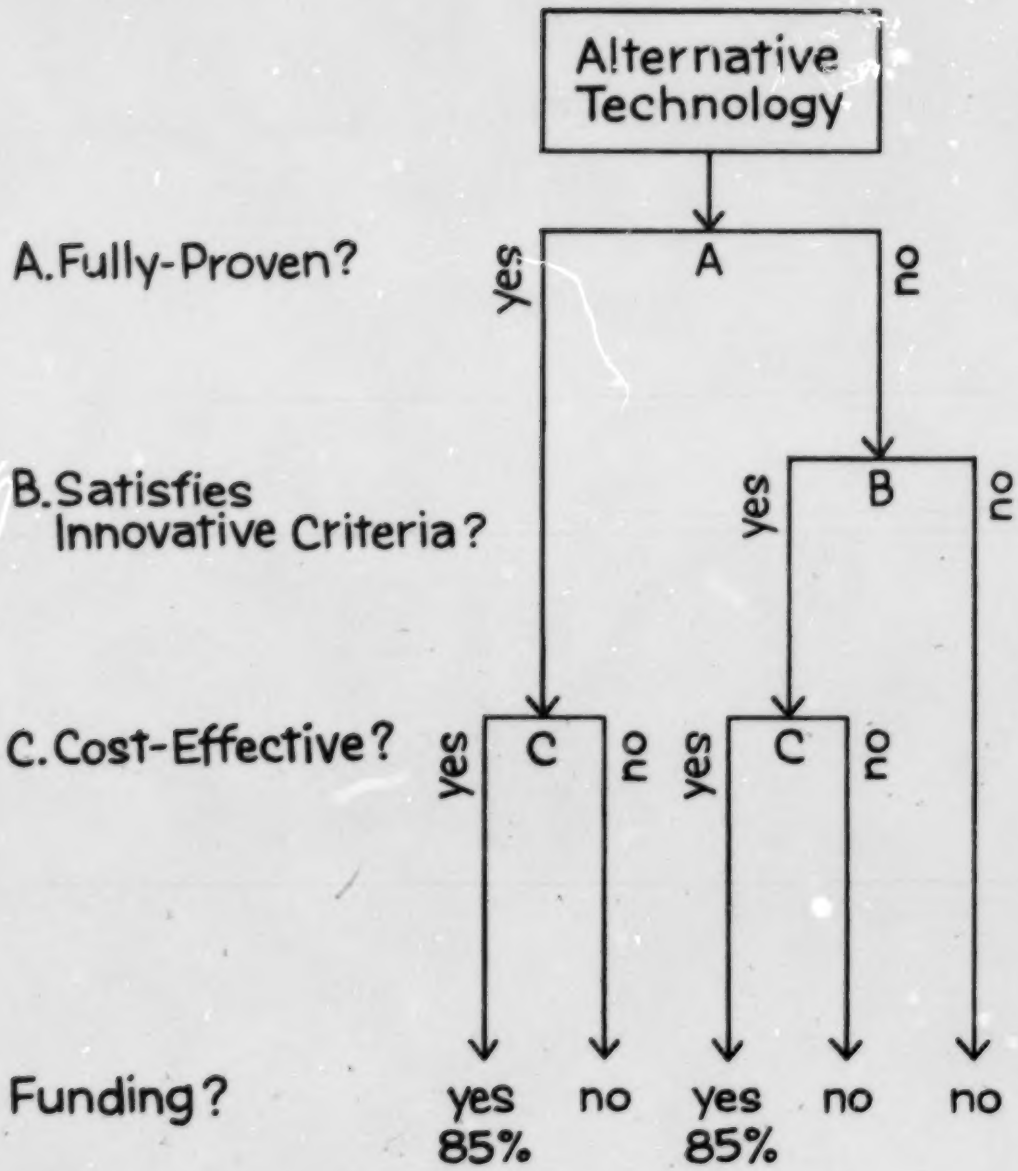
for
not - fully-proven
Conventional Treatment
Methods

CONVENTIONAL TECHNOLOGIES

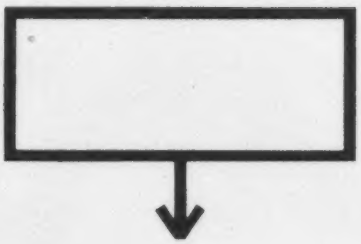
- Primary clarifer
- Trickling filter
- Activated sludge
- Alum, lime, or iron addition

MULTIPLE USES

- Community gardens
- Picnic area
- Baseball field
- Skating rink
- Tennis courts
- Bicycling, hiking, and snowmobiling trails
- Fishing and hunting
- Meeting rooms
- Environmental education


Alternative Technology
A. Fully-Proven?
A
yes
no
B. Satisfies Innovative Criteria?
B
yes
no
C. Cost-Effective?
C
C
yes
no
yes
no
Funding?
yes 85%
no
yes 85%
no
no

Option F



Quaker Lake Wastewater Treatment

Hypothetical Options

The following hypothetical options have been developed for use with the Quaker Lake case study. They are designed to provide practice in using the innovative and alternative decision-making methodology chart.

When considering various options for treatment of wastewater, they should provide equivalent effluent quality and/or solve the water quality problem that exists. The problem at Quaker Lake included:

- eutrophication due to septic tank effluent containing phosphates
- nuisance surfacing of septic effluent
- potential health problems due to inadequately treated effluent.

There are several possible solutions to the poor water quality at Quaker Lake. The following options will be evaluated as to whether or not they are considered innovative technology and can qualify for 85% funding.

Option A: Onsite disposal with septic tanks and seepage beds

Onsite disposal, as it existed, was not able to control the lake eutrophication, health, and nuisance problems. However, onsite disposal combined with water conservation and a ban on detergents containing phosphates will be able to alleviate the problem. Drastic water conservation measures will reduce the problem of failing seepage beds. Exclusion of detergents containing phosphate would eliminate eutrophication caused by the phosphate. However, implementing the water conservation program and phosphate-detergent ban will be difficult problems for the community.

Septic systems still needing replacement after water conservation as well as routine maintenance and septage treatment will be handled as a community funded and controlled project. The system will have very small energy requirements and cost only twenty-five percent of the most cost-effective conventional treatment option.

Option B: Onsite disposal with septic tanks and cluster seepage beds

Septic tanks with a properly located common leach field will correct surfacing and wastewater organic problems. The wastewater can be moved to sites more amenable for seepage beds (better soil profile and greater distance to the lake and groundwater) using grinder pumps for each household. The total system will however be owned and maintained by the community. The system's life-cycle cost will be only 35 percent of the most cost-effective conventional system and energy consumption is small. However, eutrophication caused by phosphates from detergents will still be a problem since effluent is not removed from the watershed.

Possible multiple uses include community gardens and picnic area.

Option C: Gravity sewers, extended aeration activated sludge, chemical precipitation of phosphate, and discharge into lake watershed

This is a conventional system of wastewater treatment that is fully proven and will meet the effluent requirements for discharge into the lake. The life-cycle cost of the system is one of the highest for conventional options and no energy will be saved over other options. In fact it is the most energy-intensive option. Also sludge disposal on land must frequently be used as well. Sewer rights-of-way can be used for bicycling, hiking, and snowmobiling; possibly, fishing in the lake.

Option D: Gravity sewers, extended aeration activated sludge, and effluent discharge by pumping out of the watershed

This option is identical to Option C except phosphate removal by chemical precipitation is unnecessary since the effluent is removed from the watershed. Pumping costs are traded for reduced chemical costs and reduced sludge production. It is the most cost-effective conventional option. It is a fully-proven system. Sewer rights-of-way can be used for bicycling, hiking, and snowmobiling; possibly, fishing.

Option E: Small diameter pressure sewers, aerated lagoon, filtration, and surface discharge outside the watershed

Pressure sewers fed by grinder pumps at each household discharge into an aerated lagoon. The overflow from the lagoon is outside the watershed of the lake, therefore, requiring no phosphate removal. The system's life-cycle cost is less than conventional Option D and requires minimal operational attention. Sludge disposal is only necessary at several year intervals. This was the system actually chosen.

Option F: Small diameter pressure sewers, holding pond, and spray irrigation

A pressure sewer fed by grinder pumps at each household discharges into a remote holding pond prior to periodic spray irrigation. Due to the poor soil character and steep grades there is a large distance between the holding pond and the large irrigation site. The life-cycle cost of the system is 110 percent of the most cost-effective conventional system, Option D. Energy consumption is only 50 percent of the most cost-effective conventional system.

Of all the options land treatment holds the most potential for multiple uses. Community gardens, farms, and playing fields are common. Bicycling, hiking, hunting, and snowmobiling can be achieved on spray-irrigated lands. The system also can be used in environmental education.

A/V Script:

Innovative and Alternative Technologies For Municipal Wastewater Treatment

Slide Description	Narrative
1. Words: Title slide	Music
2. Picture: Clean water	Water is among the most essential and highly treasured of all our resources. It is treasured for its great beauty as well as for a host of uses.
3. Picture: Polluted water	Unfortunately, many of the uses tend to pollute water, and often result in scenes like this.
4. Words: Public Law 92-500	But man-made problems may have man-made solutions. The Federal Water Pollution Control Act Amendments, or Public Law 92-500, were passed by Congress in 1972 to begin the organized clean-up of our nation's waters.
5. Picture: Point source	One of the most important provisions of the Act deals with the problem of municipal sewage treatment plant effluents. The Construction Grants Program was developed to help eliminate this problem. It provides Federal funding for up to 75 percent of the total cost of designing and constructing municipal wastewater treatment facilities to help attain the water quality goals set by the Act.
6. Picture: People swimming	These goals include making the nation's waters "fishable and swimmable" again by 1983, and eliminating all discharge of pollutants to water bodies by 1985.
7. Picture: Sewage plant	To date, billions of dollars have been spent by the Federal Government to help local communities construct or update wastewater treatment plants; however, much work remains to be done.
8. Picture: National capitol	Congress amended the Water Pollution Control Act again in 1977 to re-define the task remaining and to encourage continuing efforts to attain the 1972 goals.

9.	Words: Clean Water Act of 1977	And while this mid-course correction, commonly called the Clean Water Act of 1977, does not represent a complete reorientation from the 1972 Act, it does contain significant changes of emphasis in certain programs.
10.	Drawing: Fork in the Road	One change is in the Construction Grants Program. Alternative technologies for wastewater treatment may be more economical than conventional methods,
11.	Picture: Conventional treatment plant	yet, there is a tendency to cling to conventional systems without adequate consideration being given to the available alternatives. The design of new plants often comply with the letter of the law but not really with its intent.
12.	Cartoon: Effluent $$$ down the creek	For example, discharges of wastewater effluents sometimes contain valuable nutrients, such as nitrogen and phosphorus, causing pollution problems down stream.
13.	Picture: Sludge accumulation	And ever increasing accumulations of sewage sludge create new disposal problems that require special attention and management.
14.	Picture: Conventional system	But probably worst of all is when small communities end up with expensive wastewater treatment systems when simpler and more economical solutions are available.
15.	Words: Innovative and alternative technologies	Recognizing that a stimulus was needed to overcome such problems, Congress restructured the Construction Grants Program in 1977 to encourage the use of innovative and alternative technologies in wastewater treatment.
16.	Drawing: Money bags	The law provides an increase in the Federal share from 75 percent for conventional systems to 85 percent of the cost for designing and constructing innovative and alternative treatment facilities.
17.	Drawing: Tune-up	To further reduce the risk to municipaliites in building innovative and alternative facilities, Congress has instructed the U.S. Environmental Protection Agency to provide up to 100 percent of the cost to modify or replace such a system that fails within two years when operated properly.

18. Drawing: Silver dollar set aside

The Law also provides that certain percentages of money be set aside in each state to be used only for funding innovative and alternative projects. A grant application may therefore receive priority funding if the technology to be used can be classed as innovative or alternative.

19. Picture: Scenes of agriculture, industrial reuse

In general, innovative and alternative technologies make use of systems which reclaim and reuse water, recycle wastewater constituents or otherwise eliminate their discharge, or recover energy from the wastes.

20. Words: Innovative technologies

Innovative technologies for wastewater treatment are unique in that they show promise for success and cost-effectiveness, but have not been fully proven under the circumstances of their intended use.

21. Map: EPA regions

In the final analysis, the EPA Regional Administrator will determine which proposals are innovative, but here are some guidelines to help in the preliminary stages of the planning process.

22. Drawing: Cash Register (15%)

For conventional treatment systems to be innovative, the projected life-cycle cost of the treatment works must be at least 15% less than the most cost-effective system that does not use the innovative technology, or

23. Drawing: Conventional system with 20% superimposed

the net primary energy required for the operation and maintenance of the treatment works must be at least 20% less than the net energy required to operate the most cost-effective conventional system.

24. Words: Life-Cycle Cost Reduced by 15%, or Energy Requirement Reduced by 20%

For alternative technology to be innovative, it must meet one of the criteria above or fulfill any one of four additional criteria.

25. Drawing: Simple mechanism vs. Rube Goldbert device

One, improve operational reliability and thus decrease the susceptibility of the system to upsets or interference,

26.	Picture: Beautiful lake scene	two, improve environmental benefits such as water conservation and reuse, more effective use of land and improved groundwater quality,
27.	Drawing: Municipality with suburban industry	three, improve the joint industrial municipal treatment potential where both discharge into the municipal system, or
28.	Picture: Dead fish	four, improve the mangement of toxic materials that occur in the wastewater.
29.	Words: Public Benefits Benefits Through Advanced Technology	And in addition, a system may be declared to be innovative by the EPA Regional Administrator because it provides significant public benefits through the advancement of technology in a specific region.
30.	Drawing: Box labeled alternative technology	We have reviewed what makes a treatment system "innovative" now let us examine in some detail what is meant by "alternative" or "non-conventional" technologies, and look at some examples.
31.	Words: <u>Alternative Technologies</u> will do at least one: · Reuse water · Reclaim valuable constituents · Eliminate the discharge of pollutants · Recover energy	Alternative wastewater treatment technologies have been proven in actual practice and they will: reuse water, reclaim wastewater constituents, eliminate discharges of pollutants, <u>or</u> recover energy from the wastes.
32.	Picture: Farmland, forests, etc., (multiple)	Examples of alternative treatment technologies for municipal wastewater include the use of the effluent in agriculture, silvaculture, and horticulture.
33.	Picture: Lagoon	EPA guidelines list nineteen different alternative technologies dealing with effluent treatment, sludge management, energy recovery and on-site systems. Included in these are total containment ponds and ponds for pretreatment and storage prior to other uses.

34.	Picture:	Water hyacinths	An aquaculture practice that shows considerable promise particularly in warm climates is growing water hyacinths in basins of wastewater effluent. The plants remove nutrients from the water and may be harvested for a variety of uses.
35.	Picture:	Composite of sludge application, irrigation and horticulture	Other examples include application of sludge to the land, irrigation of agricultural crops and horticultural uses.
36.	Picture:	Sludge drying bed	Alternative technologies for applying sludge to the land include such supplemental processes as composting and drying.
37.	Picture:	Bulldozer on disturbed land	Another activity considered to be an alternative treatment process is the reclamation of disturbed lands by using municipal effluents and sludges in the revegetation process.
38.	Picture:	Grassed slope	The large quantities of plant nutrients in the effluent tend to reduce fertilizer costs and greatly speed up revegetation efforts, thereby reducing erosion and bringing the disturbed land back to normal conditions more quickly.
39.	Picture:	Illinois report	Another area of alternative technology deals with the application of sewage sludge to the land. Although formal systems of sludge application are not widely employed in the United States, a 1975 report of the Illinois Environmental Protection Agency indicated that over 90 percent of Illinois communities were applying sludge to agricultural land in some manner.
40.	Drawing:	Multi-hearth incinerator	Several alternative technologies focus on the recovery and use of energy from municipal sludges. Energy recovery alternatives include the co-disposal of sludge and refuse, as shown in this diagram of a multi-hearth incinerator.

41.	Drawing: Set of scales	Self-sustained incineration of sludges can also qualify as alternative technology if the amount of energy recovered and used is greater than the energy required to dewater the sludge in preparation for incineration.
42.	Picture: Small community	One broad area of alternative technologies is designated only for communities having a population of 3,500 or less, or for highly dispersed sections of larger communities that existed prior to the legislation in 1972.
43.	Drawing: Clustered housing units	These "on-site" systems may be publically or privately owned and include wastewater treatment alternatives for individual home units, clustered units and small centralized commercial developments that are not connected to centralized wastewater collection systems.
44.	Drawing: Pressure or vacuum sewers	In conjunction with these alternatives, small-diameter pressure or vacuum sewers are often desirable over conventional gravity sewers and are considered alternative technology for funding purposes when shown to be cost-effective in small communities.
45.	Drawing: Septic tank and absorption bed	A septic tank and soil absorption system is economical and environmentally sound under favorable soil and groundwater conditions and may be fundable as alternative technology in small communities.
46.	Drawing: Mound system	For areas in which conditions are not suited to traditional soil absorption, a mound system may provide satisfactory treatment of the wastewater by increasing the effective depth of soil and the total surface area for water absorption.
47.	Drawing: Aerobic treatment facility	Aerobic treatment of wastewater is an alternative to the septic tank for on-site disposal of wastewater and where properly operated and maintained may yield a higher quality effluent than the septic tank.

48.	Picture: Spray irrigation	Not let us examine in some detail one good example of an alternative technology for municipal wastewater treatment -- that of applying wastewater to the land. Land treatment has been extensively tested in the United States and in many other countries of the world, but has not yet been developed to its full potential.
49.	Drawing: Vegetation, soil surface and soil profile	Land treatment of wastewater entails the use of vegetation, the soil surface, and the soil profile to bring about renovation of the wastewater.
50.	Words: LAND APPLICATION MAY PROVIDE · Irrigation water supply · Valuable plant nutrients · Recharge of groundwater	In addition to wastewater treatment, land treatment may also provide a guaranteed supply of irrigation water, valuable plant nutrients such as nitrogen and phosphorus, and a recharge of groundwater supplies.
51.	Picture: Innovative and Alternative Technology Assessment Manual	When examining the various alternatives and determining which ones might qualify for Federal cost-share funding EPA's Publication Number MCD 53 - Innovative and Alternative Technology Assessment Manual - will be very helpful.
52.	Picture: Small community	This is especially true for smaller communities where economies of scale are not available with conventional treatment systems but alternative systems are well-suited for managing small wastewater flows.
53.	Drawing: Three red apples labeled, conventional, innovative and alternative. Must study and compare before choosing.	The Law provides that every applicant for a construction grant must have fully studied and compared innovative and alternative wastewater treatment technologies with conventional methods before selecting a system to be installed.
54.	Drawing: John Q. Citizen holding 75% bag reaching for 10% bag from Uncle Sam	Remember that innovative and alternative projects qualify for 85 percent federal funding for design and construction. The Law also provides that projects or portions of projects already underway may qualify for the additional 10 percent in federal funding if they qualify as innovative and alternative.

55.	Words:	Increased priority for funding Innovative system Alternative system	The various states are authorized to increase the priority for funding of project applications where innovative and alternative technologies are designed into the system.
56.	Picture:	Split-technical evaluation/education	The Law also provides for grants of up to 100 percent of the costs for technical evaluation and for dissemination of information pertaining to the treatment works in innovative and alternative systems.
57.	Words:	Innovative or Alternative Technologies should do at least one	In summary, innovative and alternative wastewater treatment technologies should reduce cost, save energy, increase reliability, manage toxic materials better, provide environmental benefits, improve management of joint municipal-industrial systems or clearly serve the public interest.
58.	Drawing:	Plans on drawing board	To encourage the use of innovative and alternative wastewater treatment technologies where practical, the Clean Water Act of 1977 requires that innovative and alternative technologies be studied and evaluated for each proposed project before an engineering or construction grant is made.
59.	Drawing:	Bar graph contrasting conventional with innovative/alternative funding	Innovative and alternative systems frequently have lower overall costs than conventional systems, and since they qualify for an incease in Federal funding from 75% to 85%, this can result in a significant reduction in local costs.
60.	Drawing:	Second version of tune-up	Finally, if an innovative or alternative system fails within two years, the Federal Government can fund the total amount necessary to modify or replace the system.
61.	Picture:	Municipal building	Clearly, every municipality involved in planning wastewater treatment facilities is challenged to be innovative and to consider all possible alternatives before deciding the best technology for a particular situation.

62.	Picture: Advisory group	Citizen advisory groups should encourage the use of innovative and alternative technologies. This may be done by asking the grantee and his consultants to consider the options just reviewed.
63.	Picture: Advisory group member	The citizen advisory group can support these options with their knowledge of the local situation, for example, suggesting where land might be available for land disposal of effluent.
64.	Map: States, regional offices and national offices	For further details, contact the appropriate State agency, EPA Regional Office, or the U.S. Environmental Protection Agency in Washington, D.C. We are all working together to improve and maintain the natural environment of the United States for present and future generations.
65.	Credit slide	Music
66.	Credit slide	Adapted by Penn State ....

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Working for Clean Water is a program designed to help advisory groups improve decision making in water quality planning. It aims at helping people focus on essential issues and questions, by providing trained instructors and materials suitable for persons with non-technical backgrounds. These materials include a citizen handbook on important principles and considerations about topics in water quality planning, an audiovisual presentation, and instructor guide for elaborating points, providing additional information, and engaging in problem-solving exercises.

This program consists of 18 informational units on various aspects of water quality planning:

- Role of Advisory Groups
- Public Participation
- Nonpoint Source Pollution: Agriculture, Forestry, and Mining
- Urban Stormwater Runoff
- Groundwater Contamination
- Facility Planning in the Construction Grants Program
- Municipal Wastewater Processes: Overview
- Municipal Wastewater Processes: Details
- Small Systems
- Innovative and Alternative Technologies
- Industrial Pretreatment
- Land Treatment
- Groundwater Contamination
- Multiple Use
- Environmental Assessment
- Cost-Effectiveness Analysis
- Wastewater Facilities Operation and Maintenance
- Financial Management

The units are not designed to make technical experts out of citizens and local officials. Each unit contains essential facts, key questions, advice on how to deal with the issues, and clearly-written technical backgrounds. In short, each unit provides the information that citizen advisors need to better fulfill their role.

This program is available through public participation coordinators at the regional offices of the United States Environmental Protection Agency.